

GUJARAT GAS MARKET STUDY

Interim Report

Prepared for:

YEMEN LNG COMPANY

Prepared by:

TATA ENERGY RESEARCH INSTITUTE

Darbari Seth Block, Habitat Place, Lodhi Road

NEW DELHI – 110 003 INDIA

Tel: +91-11-4622246 / 4601550

Fax: +91-11-4621770 / 4632609

e-mail: amkedia@teri.res.in

August 1998

Project Director

Mr. R K Batra

Operational Manager

Mr. Amitabh Kedia

Project Advisors

Mr. A Sen

Mr. K Ramanathan

Team Members

Mr. D D Arora

Ms. Preeti Bhandari

Dr. Sujata Gupta

Mr. Gaurav Bhatiani

Mr. Rahul Deep Singh

Ms. Vandana Bhatnagar

Mr. D D Bhujanga Rao

Secretarial Assistance

Ms. K Y Valsa

TABLE OF CONTENTS

TERMS OF REFERENCE.....	v
CHAPTER 1	
CURRENT ENERGY DEMAND/SUPPLY SCENARIO	1
1.1 INTRODUCTION.....	1
1.2 ELECTRICITY	2
1.2.1 <i>Gujarat Electricity Board</i>	2
1.2.2 <i>The Ahmedabad Electricity Company</i>	4
1.2.3 <i>Surat Electricity Company</i>	4
1.2.4 <i>Supply Position</i>	5
1.3 COAL	7
1.4 HYDRO RESOURCES.....	8
1.5 NATURAL GAS.....	8
1.6 PETROLEUM PRODUCTS	10
1.7 RENEWABLE ENERGY.....	10
CHAPTER 2	
STRUCTURE OF ELECTRICITY INDUSTRY IN GUJARAT	11
2.1 INTRODUCTION.....	11
2.2 ROLE OF GEB.....	11
2.2.1 <i>Operations of GEB</i>	12
2.3 RESTRUCTURING OF THE ELECTRICITY INDUSTRY IN GUJARAT.....	18
CHAPTER 3	
CONTRACTUAL ARRANGEMENTS FOR SALE OF GAS	19
3.1 INTRODUCTION.....	19
3.2 RELATIONSHIP BETWEEN ONGC & GAIL.....	19
3.2.1 <i>Private Gas Producers</i>	20
3.3 CONTRACTS BETWEEN GAIL AND CUSTOMERS.....	21
3.3.1 <i>Issues</i>	22
3.4 CONTRACTS WITH LOCAL DISTRIBUTING COMPANIES	23
3.5 EXPECTATIONS FOR THE FUTURE.....	23
CHAPTER 4	
PRICE STRUCTURE OF FUELS.....	25
4.1 INTRODUCTION.....	25
4.2 COAL	25
4.2.1 <i>Domestic coal</i>	25
4.3 PETROLEUM PRODUCTS	27
4.4 NATURAL GAS PRICES.....	28

CHAPTER 5

THE POWER AND INDUSTRIAL SECTORS	30
5.1 THE POWER SECTOR.....	30
5.1.1 <i>National Thermal Power Corporation</i>	31
5.1.2 <i>Ahmedabad Electricity Company</i>	32
5.1.3 <i>Gujarat Torrent Energy Corporation</i>	32
5.1.4 <i>Essar Power Company</i>	33
5.1.5 <i>Gujarat Industries Power Company Limited</i>	33
5.1.6 <i>Gujarat Electricity Board</i>	34
5.2 THE INDUSTRIAL SECTOR	34
5.2.1 <i>The Fertiliser Sector</i>	34
5.2.2 <i>Petrochemicals</i>	36
5.2.3 <i>Other Industries</i>	37
5.2.4 <i>Industrial Estates</i>	38
5.3 POTENTIAL GAS DEMAND.....	38

CHAPTER 6

PRELIMINARY ENERGY PROJECTIONS	40
6.1 INTRODUCTION.....	40
6.2 SDP GROWTH.....	40
6.3 ENERGY-SDP ELASTICITIES	42
6.4 LONG TERM ENERGY PROJECTIONS	43
6.5 AVAILABILITY OF FUELS.....	44

LIST OF TABLES

Table 1.1: Number of consumers in different categories (1996-97)	3
Table 1.2: Consumer categorywise electrical energy sales for 1996-97 of GEB.....	3
Table 1.3: Total Electricity sales in 1995-96	5
Table 1.4: Mix of generating capacity as in March 1997	6
Table 1.5: Share of GEB in NTPC and NPC stations	7
Table 1.6: Energy generated by different utilities in Gujarat	7
Table 1.7: Sector-wise coal consumption	8
Table 1.8: Hydro capacity in Gujarat	8
Table 1.9: Production pattern of gas fields in Gujarat.....	8
Table 1.10: Current Gas Consumption	9
Table 1.11: Consumption of major petroleum products	10
 Table 2.1: Consumer categorywise electrical energy sales for GEB (1996-97)	13
Table 2.2: Generating Stations owned by GEB.	14
Table 2.3: Voltage-wise break-up of substations of GEB.....	15
Table 2.4: Working results of GEB	18
 Table 4.1: Coal pricing at pithead.....	26
Table 4.2: Price build-up for coal sold at Gandhinagar from SECL.....	26
Table 4.3: Prices of petroleum products, ex-Koyali, as on 6 th August 1998	27
Table 4.4: Gujarat state sales tax.....	28
Table 4.5: Price of gas for NTPC Kawas (for the quarter April - June 1998).....	29
 Table 5.1: Power stations in Gujarat	30
Table 5.2: Preliminary gas demand estimates.....	39
 Table 6.1: Gujarat – socio-economic indicators.....	41
Table 6.2: Gujarat Energy-SDP Elasticities	42
Table 6.3: All-India Energy-GDP Elasticities	43
Table 6.4: Projections — Low Growth Scenario	43
Table 6.5: Projections — Medium Growth Scenario	43
Table 6.6: Projections — High Growth Scenario	44

LIST OF FIGURES

Figure 1.1: Consumer categorywise shares in electricity sales for 1996-97.....	4
Figure 1.2: Categorywise sales of SEC for the year 1995-96	5
Figure 1.3: Share of different fuels in existing capacity.....	6
Figure 1.4: Allocation of natural gas among different sectors in Gujarat.....	9
 Figure 2.1: Comparison of sales of GEB, AEC and SEC.....	13
Figure 2.2: Capacity ownership in Gujarat.....	14
Figure 2.3: Share of different fuels in capacity owned by GEB	15
 Figure 6.1: Net State Domestic Product for Gujarat (1980/81 prices).....	41
Figure 6.2: Energy-SDP Elasticities for Gujarat.....	42

TERMS OF REFERENCE

A. OBJECTIVES

In order of priority:

- Review and understand the Gujarat gas market: demand, structure, customers and typical terms
- Review and understand competing fuels
- Overview on the India gas market
- Review and understand fiscal and regulatory environment

B. THE STATE OF GUJARAT DETAILED MARKET SURVEY

1. Gas market structure in the state of Gujarat

a) Determine present and future potential gas market sectors and associated demand: power, fertilisers, chemicals, petrochemicals, other categories of consumers (industrial, residential/commercial).

b) Determine the competing fuel mix (gas, naphtha, fuel oil, gas oil, coal, other) overall and by market sector (present and future) and in particular in power and fertiliser sector.

c) For each of the power, fertiliser, chemical and petrochemical market sectors, determine:

- major customers;
- existing capacities and fuels used;
- on-going expansion;
- planned new units;
- existing gas consumption;
- estimated unsatisfied gas demand;
- existing fuel consumption and potential equivalent gas consumption (indicate whether from fuel conversion or new units) and growth forecasts.

d) For the other categories of consumers, identify large and reliable existing and potential users of natural gas (including clusters of customers and distribution networks) with equivalent consumption greater than 50,000 tons per annum of liquefied natural gas (LNG):

- segment the consumers by type of industry and consumption pattern (interruptible, continuous, etc.)
- forecast the annual growth rate for fuel/feedstock demand for the 25 years starting 2000 for such consumers.

e) Evaluate the existing and potential customers along the HBJ line (same information as above).

2. Price issues

a) Describe the existing and future (2003 and beyond) price structure for all fuels used in the state of Gujarat: natural gas, naphtha, fuel oil, gas oil, coal, etc.

- existing price levels;
- applicable taxes;
- applicable price regulation and economic environment;
- transportation cost and its incidence;
- subsidies;
- currency of payment;

b) Determine the price parity for gas to replace competing fuels and indicate the assumptions (capex, opex, other) made for that computation. Evaluate the impact of subsidies, including contribution to gas price (i.e. what would be the maximum sustainable gas price in the absence of subsidies)

3. Contractual issues

Describe the existing contractual framework for all existing and potential users of natural gas, including *inter alia*:

- duration;
- takes/flexibilities;
- price/re-openers;
- guarantees available (including payment, ToP);
- currency of payment and foreign exchange risk.

4. Customers summary sheet

For each of the identified customers (under B.1.c and d), summarise available information in a "customer summary sheet" including:

- company name;
- market sector;
- activity, location;
- shareholding structure;
- financial data (audited when available): balance sheet, P&L, financial institutions evaluation when available, etc.);
- current fuel used (source) and usage;
- current volume of consumption and expenditure;
- expansion plans;
- price at which they would be willing to switch to natural gas.

GENERAL OVERVIEW ON THE INDIAN & GUJARAT GAS MARKET

India overview

Supply/demand

Gas infrastructure

Supply/demand scenarios in the state of Gujarat

a) Determine the supply-demand balance for primary energy, electricity and gas in the state of Gujarat in 1998.

b) Determine the supply-demand scenarios (low, base and high case) for primary energy, electricity and gas in the state of Gujarat for the 2000-2015 time frame (and an estimate for 2015-2025). Indicate the assumptions used in the scenarios determination.

Power and gas infrastructure in the state of Gujarat

a) Review the existing and future power network in the state of Gujarat: high voltage lines and distribution network; ownership of such transmission line/network and access of third party to transmission line network.

b) Review the existing and future gas logistics in the state of Gujarat: high pressure pipe and distribution network; ownership of such pipe/network and access of third party to pipe/network, including those applicable to Gail's HBJ pipeline.

c) Determine typical tariffs and transportation contract terms of gas transportation.

REGULATORY AND FISCAL ISSUES

Regulatory issues

a) Determine the legislation in force applicable to the energy market in the state of Gujarat and in particular to the power and gas market.

- permits
- environmental approvals
- local, state and central government approvals
- regulated price maximum lawful prices
- subsidies
- any limitations on conversion into dollars and remittance of proceeds from gas sales or payments of gas

b) Analyse the role of the Gujarat State Electricity Board

2. Fiscal issues

Income tax, depreciation, tax holidays, tax rates, sales tax, VAT, etc...., in particular applicable taxes on fuels (petroleum products, natural gas, coal, etc...) whether applicable to indigenous fuels (excise tax, etc...) or imported fuels (import duties, etc...).

3. Deregulation considerations

Evaluate the impact on the potential gas customers of a possible deregulation (including *inter alia* end of subsidies) of the energy/gas market and/or of each of the market sectors (power, fertilisers, chemical and petrochemicals, industries, etc.).

INTERIM REPORT

The Interim Report covers the following:

1. The current energy demand/supply scenario in Gujarat, including existing fuel consumption by type and sector.
2. Electricity industry's structure in Gujarat, including the role of the Gujarat Electricity Board.
3. The terms of existing gas sales and transportation contracts.
4. Current fuel pricing in Gujarat, including duties and taxes.
5. Overview of the potential customers for regassified LNG in the power and industrial sectors, which have been visited so far.
6. Preliminary estimates of future energy demand scenarios for Gujarat.

The Interim Report has been prepared about four weeks into the project, and the contents are as per the priorities expressed by the sponsors, Yemen LNG Company, and as agreed upon during the kick-off meeting held on July 30, 1998 in London.

CHAPTER 1

CURRENT ENERGY DEMAND/SUPPLY SCENARIO

1.1 INTRODUCTION

The state of Gujarat is located on the northernmost portion of the western coast of India. It is one of the most prosperous and urbanised states in the country. The state economy has grown at a rapid pace during the past few years. The Net State Domestic Product (NSDP) at current prices grew at a rate of 3.3% during the year 1995-96. The state has high level of industrialisation and the sector registered a robust growth of 12.1% during the year 1995-96. Gujarat is considered to be an attractive market and it attracts over 10% of all investments in India.

Gujarat has experienced a rapid growth in the demand for electricity during the past few years. The per capita consumption of electricity has increased from 382 kWh to 724 kWh, over the past seven years from 1990 to 1997, recording a CARG of 9.6%. During the year 1996-97, the state recorded a peak shortage of 15.5% and energy shortage of 8.21%. Gujarat Electricity Board, a state owned utility, is the primary electricity supplier in the state.

The total installed capacity at the end of the year 1996-97 was 7052 MW. Most of the power generation in the state is based on coal, which is transported from neighbouring states. There are limited lignite resources of about 324 MT available within the state at a few locations in Kutch, Saurashtra and South Gujarat areas. There are no storage hydro reservoirs in the state at present.

The total consumption of gas in 1997-98 amounted to 6139 MMCM. Major consumers of natural gas were Fertiliser, Power and Sponge Iron and they respectively accounted for 33%, 32%, and 14% of the total sales. Gujarat has two major gas producing fields with reserves amounting to about 90 BCM. The production for the year 1997-98 was about 2540 MMCM. Gujarat also receives gas from offshore fields in Bombay High.

Gujarat is the second largest consumer of petroleum products in the country. The consumption of petroleum products increased from 6712 thousand tons in 1994-95 to 8350 thousand tons in 1997-98, recording a CARG of 11.5%. The state has crude oil reserves amounting to 153.2 million tons. These are mostly concentrated in the southern part of Gujarat.

Potential for wind and solar power also exists to a limited extent.

1.2 ELECTRICITY

The distribution of electricity in Gujarat is done by three independent utilities. These are the Gujarat Electricity Board (GEB), the Ahmedabad Electricity Company (AEC) and the Surat Electricity Company (SEC). GEB is a vertically integrated state utility supplying electricity to more than 80% of the total consumers in Gujarat. The other two are private utilities licensed by the Government of Gujarat to operate in limited areas in the state.

GEB owns more than 63% of the generating capacity in the state. Other organisations, which own generating capacity in the state include the AEC, the utilities owned by the Central Government i.e. the National Thermal Power Corporation (NTPC) and the Nuclear Power Corporation (NPC), and Independent Power Producers (IPPs). The state, through GEB, has an allocation in the installed capacity of the central sector generating stations owned by NTPC and NPC.

In the post liberalisation era, the pace of industrial and economic growth has accelerated, resulting in an increasing demand of electricity by various sectors of economy. Gujarat experienced a peak demand of 6100 MW during the year 1996-97. The peak demand actually catered was 5151 MW, representing a peak shortage of about 15.5%. The energy shortage during the same period was of the order of 8.21%.

Consumption

The per capita consumption of electricity in the state in 1996-97 was 724 kWh, which was twice the national average of 363 kWh. There were more than 7.0 million consumers in the state at the end of 1996-97, a majority of whom was catered to by GEB.

1.2.1 Gujarat Electricity Board

The Gujarat Electricity Board, a state owned organisation, is the primary electricity supplier in Gujarat and is responsible for all three activities - generation, transmission and distribution in the state. It owns 63% of the total installed capacity in the state excluding the captive generating units. GEB had a consumer base of 6,131 thousand consumers, representing more than 80% of the total consumer base, in 1996-97. It accounted for more than 86% of the total electricity sales in 1995-96. The rest was accounted for by sales of AEC and SEC. The details of AEC and SEC are available at Sections 1.2.2 and 1.2.3 respectively.

Detailed break up of number of consumers in different categories, for GEB, is provided in Table 1.1.

The total sales by GEB, during the year 1996-97, amounted to 23558 million kWh, excluding the sales to other utilities. This was 3.6% over the total sales in 1995-96. Irrigation was the single largest consumer of electricity in GEB system accounting for

approximately 43% of the total energy consumption. Industry accounted for about 42%, while the share of domestic and commercial was 10% and 3% respectively.

Table 1.1: Number of consumers in different categories (1996-97)

S. No	Category	Number ('000)
1.	Domestic	4757
2.	Commercial	665
3.	Industry (LT and HT)	168
4.	Public Lighting	17
5.	Public Waterworks	19
6.	Irrigation	505
	TOTAL	6131

Of the major sectors, industry and commercial sectors experienced the highest growth rate with industry growing at nearly 7.8% while the commercial sector grew at 5.0%. Domestic sector and supply to railway traction experienced a growth rate of approximately 4% each. Supply to agricultural sector for irrigation purposes declined marginally. The details of categorywise sales of electrical energy for the year 1995-96 and 1996-97 of GEB are given in the Table 1.2.

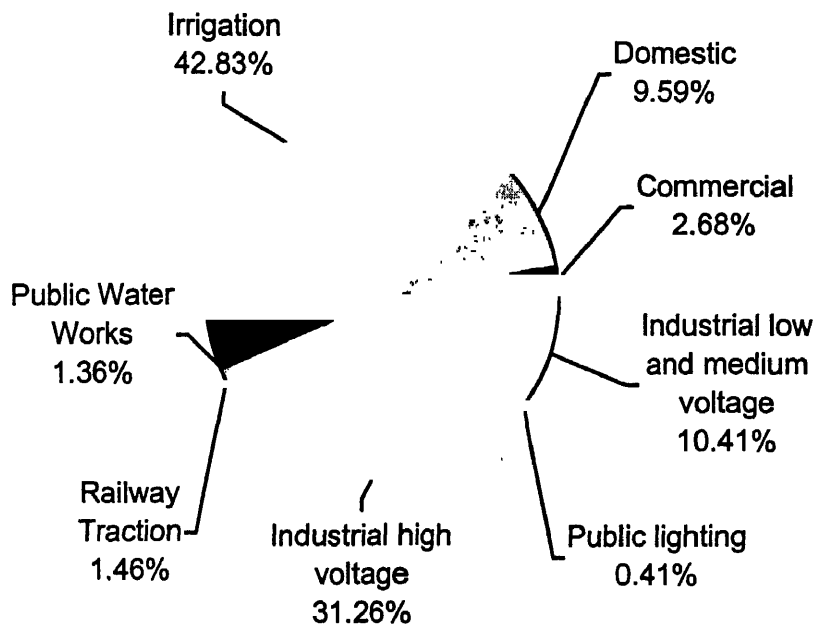
Table 1.2: Consumer categorywise electrical energy sales for 1996-97 of GEB

S. No	Category	Million kWh sold		Growth Rate %
		1995-96	1996-97	
1.	Domestic	2176	2260	3.9
2.	Commercial	601	631	5.0
3.	Industrial Low and Medium Voltage	2283	2453	7.4
4.	Industrial High Voltage	6826	7364	7.9
5.	Irrigation	10133	10089	-0.4
6.	Railway Traction	331	344	3.9
7.	Public Water Works	299	320	7.0
8.	Public Lighting	94	97	3.2
	TOTAL	22746	23558	3.6

Figure 1.1 demonstrates the share of different categories in the sales of the GEB for the year 1996-97.

Maximum unrestricted demand in the GEB system during the year 1996-97 was 6054 MW. However, maximum demand catered was 5001 MW. This represents a peak shortage of 17.39% in the GEB system.

Figure 1.1: Consumer categorywise shares in electricity sales for 1996-97



1.2.2 The Ahmedabad Electricity Company

The Ahmedabad Electricity Company (AEC) is a private licensee, for generation and distribution of electricity in and around the city of Ahmedabad. The licence has been granted by Government of Gujarat under the Indian Electricity Act, 1910. It had a consumer base of approximately 8,87,000 in 1996-97. The total sale for the year 1996-97 was 2466 million kWh, excluding the sale to other utilities. About 984 million kWh was accounted for by public and private lighting and fans, while 1482 million kWh was sold in HT and LT Power category.

1.2.3 Surat Electricity Company

The Surat Electricity Company (SEC) is licensed, by Government of Gujarat under the Indian Electricity Act 1910, to distribute electricity in and around the city of Surat. It had a consumer base of approximately 3,00,000 in 1995-96 spread over an area of 52 square kilometres. The total sale for the year was 1256 million kWh, which represented a growth of about 9.0% over the last year. The sales among different consumer categories are depicted in Figure 1.2. The peak recorded demand for the year 1995-96 was about 250 MVA. At present, SEC does not own any generating capacity.

Figure 1.2: Categorywise sales of SEC for the year 1995-96

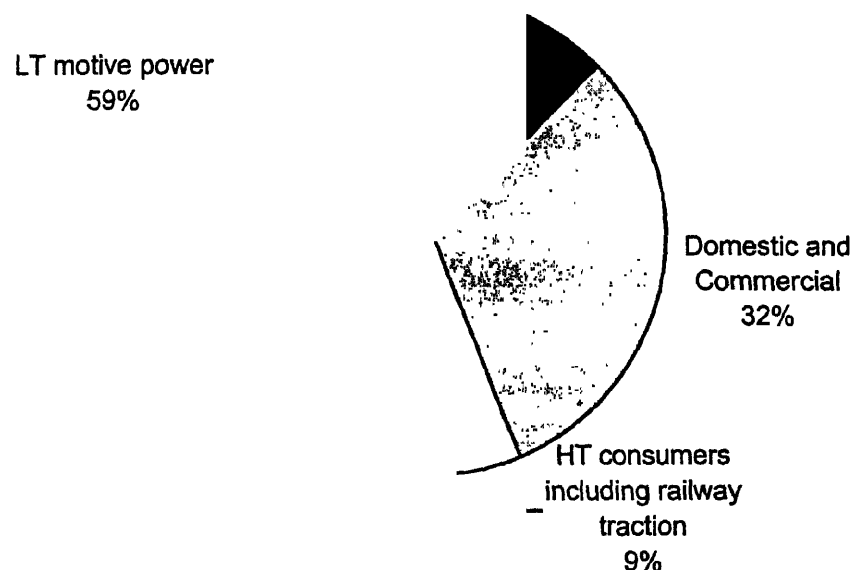


Table 1.3 provides the total electricity sales in Gujarat for the year 1995-96 and the share of different utilities.

Table 1.3: Total Electricity sales in 1995-96

Utility	Electricity Sales 1995-96 (Million kWh)	Share %
GEB	22746	86.00
AEC	2442	9.20
SEC	1256	4.80
TOTAL	26444	100.00

1.2.4 Supply Position

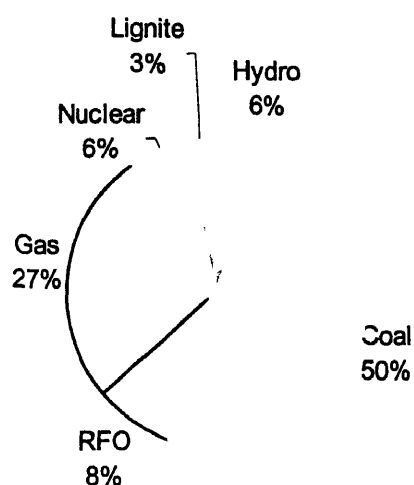
As on March 1997, power generation capacity including the central sector generating companies (utilities only), in the State was 7052 MW. The ownership of this capacity was divided between Gujarat Electricity Board, National Thermal Power Corporation, Nuclear Power Corporation, Ahmedabad Electricity Company, Gujarat Industrial Power Corporation Ltd. and Essar Power Ltd. The mix of the generating capacity along with ownership, as in March 1997 is presented in Table 1.4.

Table 1.4: Mix of generating capacity as in March 1997 (MW)

Ownership	Hydro	Coal	RFO*	Gas [#]	Nuclear	Lignite	TOTAL
GEB	427	3010	579	189	0	215	4420
NTPC	0	0	0	1305	0	0	1305
NPC	0	0	0	0	440	0	440
GIPCL	0	0	0	145	0	0	145
AEC	0	450	0	100	0	0	550
Essar Power Ltd.	0	0	0	192	0	0	192
TOTAL	427	3460	579	1931	440	215	7052
* This includes 45 MW gas fired steam turbine capacity.							
* This includes naphtha and NGL fired gas turbines.							

Since March 1997, GIPCL has added another 160 MW of CCGT capacity and Essar Power has fully commissioned its 515 MW CCGT plant. In addition, Gujarat Torrent Energy Corporation plans to have its 655 MW CCGT plant completely operational by October 1998.

The Gujarat system comprises mainly of thermal generation and hydro capacity is limited to approximately 6.0% of the total capacity. As against 6% in Gujarat, the total hydro capacity in the country comprises approximately 25% of the total installed capacity. Figure 1.3 demonstrates the share of different fuels in the capacity existing at the end of year 1996-97.

Figure 1.3: Share of different fuels in existing capacity

The state, through GEB, has an allocation in the installed capacity at the central sector generating stations owned by NTPC and NPC. This is detailed in Table 1.5.

Table 1.5: Share of GEB in NTPC and NPC stations (MW)

Station	Fuel	State	Installed Capacity	GEB's Allocation
NTPC Korba	Coal	Madhya Pradesh	2100	360
NTPC Vindhyachal	Coal	Madhya Pradesh	1260	230
NTPC Kawas	Gas	Gujarat	655	184
NTPC Gandhar	Gas	Gujarat	650	234
NPC Tarapur APS	Nuclear	Maharashtra	320	190
NPC Kakrapar APS	Nuclear	Gujarat	440	125
TOTAL			5425	1323

In 1996-97, the total energy generated by GEB was 22967 million kWh. The PLF achieved by the GEB owned plants was 65.0%. The energy generated by other generating companies during the same period is presented in Table 1.6.

Table 1.6: Energy generated by different utilities in Gujarat

S. No	Utility	Million kWh
1.	GEB	22967
2.	AEC	3134
3.	GIPCL	1049
4.	Essar Power Ltd.	392
	TOTAL	27542

1.3 COAL

There are no coal reserves in Gujarat. However, there are lignite reserves of 324 MT available at a few locations in Kutch, Saurashtra and South Gujarat areas.

Power is the largest coal-consuming sector accounting for more than 86% of the total consumption in the year 1996-97. Coal consumption in major sectors for the year 1995-96 and 1996-97 is detailed in Table 1.7.

South Eastern Coal Fields (SECL) in the state of Madhya Pradesh, Western Coal Fields (WCL) in the state of Maharashtra and Mahanadi Coal Fields (MCL) in the state of Orissa are the major sources of coal supply to Gujarat.

The total lignite production in Gujarat for the year 1996-97 amounted to about 4.94 million tons. Most of this was used in power sector.

Table 1.7: Sector-wise coal consumption ('000 tons)

Sector	Consumption		Growth (%)
	1995-96	1996-97	
Power	13684	13806	1.0
Cement	377	345	-1.0
Fertiliser and Chemicals	201	377	87.0
Paper	75	81	8.0
Textile/Rayon	207	177	-14.0
Others	1318	1181	-10.0
TOTAL	15862	15967	1.0

1.4 HYDRO RESOURCES

The state has a hydro capacity of 427 MW, which is about 6% of the total installed capacity. The details of hydro plants are provided in the Table 1.8.

Table 1.8: Hydro capacity in Gujarat

Plant	Capacity (MW)
Ukai hydro	300
Kadana hydro	120
Panam hydro	2
Ukai LBC hydro	5
TOTAL	427

There is no storage reservoir capacity in the state at present.

1.5 NATURAL GAS

The Gujarat region is the second most important gas producing region in India and production in 1996 represented about 12-13% of the total indigenous production. There are two main areas of gas supply, North Gujarat and South Gujarat fields, both of which are operated by ONGC. Whereas the North Gujarat field is an onshore field, a part of the South Gujarat field lies offshore. The total reserves of natural gas in Gujarat as estimated on 31st March 1995 were about 90 BCM. Gujarat also receives gas from the South Bassein in Bombay High through an offshore pipeline. Table 1.9 provides details about the two fields in Gujarat for the year 1997-98.

Table 1.9: Production pattern of gas fields in Gujarat

Field	Discovered	Annual Production 1997-98
		(MMSCMD)
North Gujarat	1972	1.52
South Gujarat	1972	5.44
TOTAL		6.96

The total gas allocations in Gujarat at the end of 1997-98 were of the order of 20.79 MMSCMD whereas the supply was constrained to 16.82 MMSCMD. A part of the supply was from the offshore fields in Bombay High. This amounted to 9.86 MMSCMD in 1997-98.

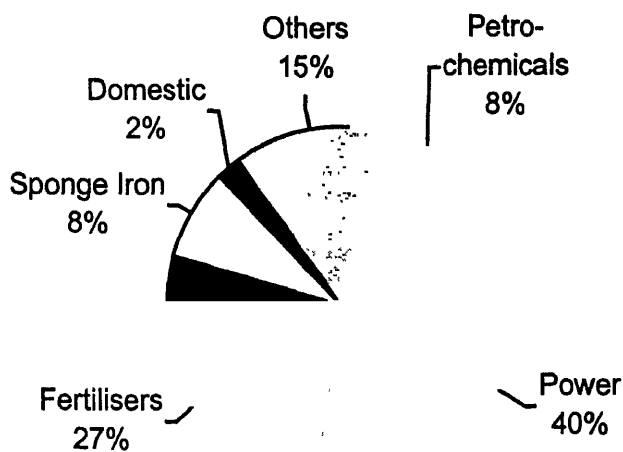
Nearly 40% of the total allocation is for the power sector. However, due to supply constraints, the sector received only about 66% of the gas allocated to it. Fertiliser sector has an allocation of about 27% and it received nearly 95% of its allocation. The consumption pattern of gas in different sectors of economy in 1997-98 is provided Table 1.10.

Table 1.10: Current Gas Consumption (MMSCMD)

Sector	Allocation	Supply
Power	8.30	5.48
Fertiliser	5.59	5.31
Domestic	0.47	0.56
Sponge Iron	1.75	2.34
Petrochemicals	1.65	1.61
Others including glass, chemicals and dairy products	3.03	1.52
TOTAL	20.79	16.82

Figure 1.4 demonstrates the relative share of different sectors in the current allocation.

Figure 1.4: Allocation of natural gas among different sectors in Gujarat



1.6 PETROLEUM PRODUCTS

Gujarat has proven and recoverable reserves of about 153.2 million tons of crude oil. The production in 1994-95 amounted to about 6.3 million tons. There is only one refinery in the state at present located at Koyali in South Gujarat with a capacity of 9.50 MMTPA. Indian Oil Corporation, an organisation under the Central government, owns the refinery.

Gujarat is one of the largest consumer of petroleum products in the country. In 1996-97, the total consumption of the petroleum products in the state amounted to 8.35 million tons, which was second only to Maharashtra. The total consumption during the year 1994-95 was 6712 thousand tons and has recorded a CARG of over 11.5% over the past two years. The product-wise break up of consumption of different products is provided in Table 1.11.

Table 1.11: Consumption of major petroleum products ('000 tons)

S. No.	Product	1994-95	1996-97
1.	LPG	289	313
2.	Gasoline	327	416
3.	Naphtha	568	590
4.	Kerosene	806	829
5.	Jet Fuel	43	67
6.	Gas Oil	2156	2947
7.	Fuel Oil	2008	2175
8.	Others	515	1013
	TOTAL	6712	8350

1.7 RENEWABLE ENERGY

Gujarat has taken some initiative to utilise the renewable energy potential in the state. Gujarat Energy Development Agency (GEDA) is a State Government aided nodal agency for promotion and popularisation of new and renewable sources of energy. The Agency promotes research programs in the field of solar energy, wind energy, energy through biogassification etc.

At the end of the year 1994-95, the installed capacity of the windfarms established in the state was 36 MW. During the year 1995-96, GEDA had established and commissioned 60 MW capacity windfarms in the state, and during the year 1996-97 (April-November 1996), 19 MW capacity windfarms had been commissioned. Thus the total installed capacity of the windfarms established in the state had reached 115 MW by the end of November 1996, which is spread over different locations in the Kutch and Saurashtra.

CHAPTER 2

STRUCTURE OF ELECTRICITY INDUSTRY IN GUJARAT

2.1 INTRODUCTION

The distribution of electricity in Gujarat is done by three independent utilities. These are the Gujarat Electricity Board (GEB), the Ahmedabad Electricity Company (AEC) and the Surat Electricity Company (SEC). GEB is a vertically integrated state utility supplying electricity to more than 80% of the total consumers in Gujarat. The other two are private utilities licensed by Government of Gujarat to operate in limited areas in the state.

2.2 ROLE OF GEB

The Gujarat Electricity Board (GEB), a state owned organisation, is the primary electricity supplier in Gujarat and is responsible for all the three activities - generation, transmission and distribution in the state. It was constituted in 1960 under the terms and conditions specified in the Electricity (Supply) Act, 1948. The Act specifies the constitution, composition, powers, duties and commercial procedures to be followed by the State Electricity Boards (SEB). The specific duties of the board include, among others, the following:

1. To arrange, in co-ordination with the generating company or companies, if any, operating in the state, for the supply of electricity that may be required within the state and for the transmission and distribution of the same in the most economical and efficient manner with particular reference to those areas which are for the time being not supplied or adequately supplied with electricity.
2. To prepare and carry out schemes for transmission, distribution and generally promote the use of electricity within the state.
3. To operate generating stations within its control in co-ordination with the generating companies, if any, and with the Government or any other board or agency having control over a power system.
4. To collect data on demand for and the use of electricity and to formulate perspective plans in co-ordination with the generating companies, if any, operating in the state, for the generation, transmission and supply of electricity within the state.

The powers of the board include, among others, the following:

1. Power to supply electricity to any licensee or person, subject to the provisions of the Act.
2. For efficient performance of its duties under the Act, the Board may prepare one or more schemes, relating to establishment or acquisitions of generating stations, tie-lines, sub-stations or transmission lines as per the procedures laid down under the Act.
3. Power to enter into agreements for purchase and sale of electricity under certain conditions.
4. Power to adjust its tariffs as per the provisions of the Act.
5. Power to make regulations, which are not inconsistent with the Act, in matters relating to, among others, the administration of funds and other property of the Board; duties, salaries, and conditions of service of its employees; making of arrangements with licensees; summoning and holding of meetings of the Board and conduct of business thereat.

In discharge of its functions, the Board shall be guided by such directions on questions of policy as may be given to it by the State Government. GEB is integrated to the Western grid of the country comprising of States of Maharashtra, Madhya Pradesh, Gujarat, Goa, Union Territories of Daman and Diu and Dadra and Nagar Haveli. NTPC, NPC and Power Grid Corporation of India Ltd. (PGCIL) are also a part of this integrated operation. This system is called the Western Regional Electricity Board (WREB). The WREB was established in 1964 in order to ensure optimum utilisation of the power resources in the region. The headquarters of WREB are located at Bombay. According to Section 55 of the Act, the Board has to comply with the directions of the Regional Electricity Board as given from time to time, for the purpose of achieving the maximum economy and efficiency in the operation of the undertaking or any part thereof.

2.2.1 Operations of GEB

Sales

GEB is recognised as one of the more progressive and better managed Boards in the country. It caters power to 6131 thousand consumers spread over the entire state of Gujarat. This represents more than 80% of the total electricity consumers in Gujarat. Total sales of GEB for the year 1996-97 amounted to 23558 million kWh, excluding the sales to other utilities. Irrigation and Industry were the two main sectors accounting for about 85% of the GEB sales collectively. Table 2.1 provides the consumer category-wise sales of GEB for the year 1995-96 and 1996-97. The

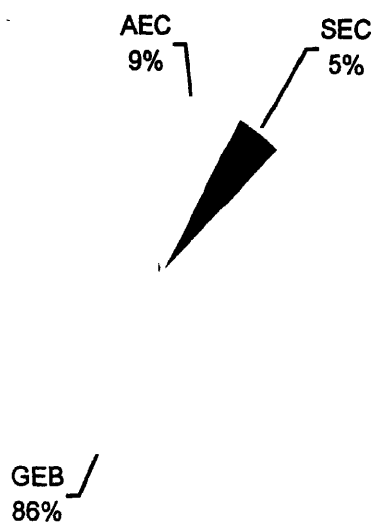
sectors that recorded the highest growth rate during the year 1996-97 were industry and commercial.

Table 2.1: Consumer categorywise electrical energy sales for GEB (1996-97)

S. No	Category	Million kWh sold		Growth Rate %
		1995-96	1996-97	
1.	Domestic	2176	2260	3.9
2.	Commercial	601	631	5.0
3.	Industrial Low & Medium Voltage	2283	2453	7.4
4.	Industrial High Voltage	6826	7364	7.9
5.	Irrigation	10133	10089	-0.4
6.	Railway Traction	331	344	3.9
7.	Public Water Works	299	320	7.0
8.	Public Lighting	94	97	3.2
	TOTAL	22746	23558	3.6

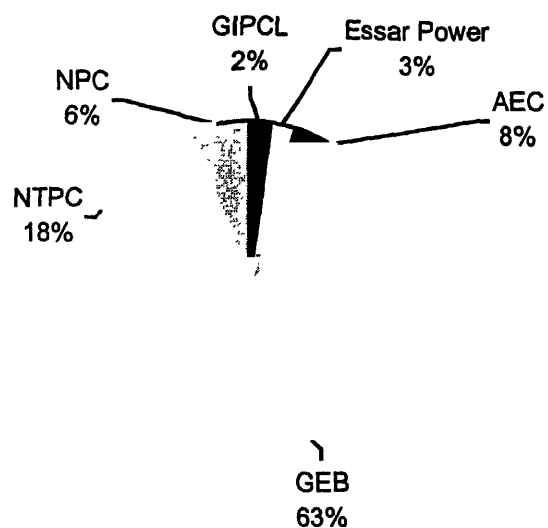
AEC and SEC are the other utilities, which supply power in Gujarat. GEB operates over the whole state, except areas that are under the control of AEC and SEC. Figure 2.1 provides a comparison of the sales of three utilities for the year 1995-96

Figure 2.1: Comparison of sales of GEB, AEC and SEC



Generation Capacity

As on March 1997, the installed capacity owned by the GEB was 4420 MW. This represents about 63% of the total installed capacity in the state. Figure 2.2 depicts the share of different utilities in the capacity in Gujarat.

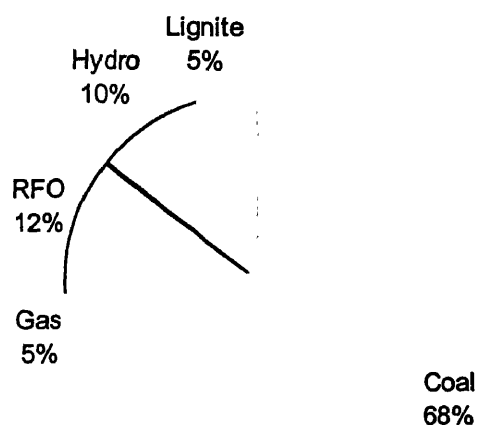
Figure 2.2: Capacity ownership in Gujarat

Most of the capacity that is owned by GEB is coal based. There are no coal reserves in the state and it is transported from the neighbouring states of Madhya Pradesh, Maharashtra and Orissa. The share of different fuels in the capacity owned by GEB is depicted in Figure 2.3. A detailed list of the plants owned by the Board, at the end of 1996-97, along with their capacity and fuel type is available in Table 2.2.

Table 2.2: Generating Stations owned by GEB.

S. No	Location	Capacity (MW)	Fuel
1.	Gandhinagar	660	Coal
2.	Ukai	850	Coal
3.	Wanakbori	1260	Coal
4.	Sikka	240	Coal
5.	Kutch	215	Lignite
6.	Utran	135	Gas
7.	Dhuvaran	54	Gas
8.	Utran	45	Gas (Steam)
9.	Dhuvaran	534	RFO (Steam)
10.	Ukai	305	Hydro
11.	Kadana	120	Hydro
12.	Panam	2	Hydro
	TOTAL	4420	

Figure 2.3: Share of different fuels in capacity owned by GEB



GEB also has an allocation of 1323 MW in the installed capacity owned by the central sector generating companies, NTPC and NPC.

Transmission and Distribution

GEB owns an extensive transmission and distribution network comprising of a total of 1,48,138 circuit kilometres of high tension transmission lines of 11 kV to 400 kV, and 1,71,309 circuit kilometres of low tension distribution lines. There are 602 substations at 33 kV and above, for managing supply of electrical energy. A voltage wise break-up of the substations is provided in Table 2.3 below.

Table 2.3: Voltage-wise break-up of substations of GEB.

S. No	Voltage (kV)	Number
1.	400	6
2.	220	48
3.	132	45
4.	66	498
5.	33	5
	TOTAL	602

Organisational Structure and Human Resource Development

GEB is managed by a Chairman and Board Members. The Board comprised of 8 Members in 1996-97, which included the Chief Secretary, the Principal Secretary for Energy and Petrochemicals, and Additional Chief Secretary-Finance to the Government of Gujarat.

The total employee strength of GEB, in 1996-97, totalled to approximately 48,000. This translates into 7.83 employees per thousand consumer served and 1.87 employees per million kWh sold. Both these indicators are among the lowest in the country.

GEB placed considerable focus on training activities. In house training programmes at various centres of the Board were arranged during the year and more than 400 employees from technical, financial and administrative wings were deputed to various short and long term courses, workshops and seminars etc. Further, the Board introduced Management Development Training Course for middle level engineers working on transmission and distribution side.

Tariff

The tariff structure in most states in the country, including Gujarat, is complicated with large number of tariff slabs built in and is also distorted. There is an element of cross-subsidy built into the tariff structure with industrial consumers, supplied power at high tension, paying more than the domestic and agricultural consumers who are supplied at low tension. Further, there is a substantial gap between the revenue earned by the Board and the expenditure incurred. This gap amounted to approximately Rs. 10695 million in 1996-97. The gap between the revenue and expenditure is bridged through the subsidy provided by the State Government. In 1996-97, the government provided subsidy to the tune of Rs. 11794 million.

Industrial Tariff: The tariff charged by GEB from the industry with contract demand of 100 kVA and above is a two-part tariff comprising of a demand charge and an energy charge. The demand charge ranges from Rs. 83 per kVA of billing demand for the first 500 kVA of recorded demand to Rs. 180 per kVA of billing demand for 2000 kVA and above. The energy charges are Rs. 1.59 per kWh for all units consumed. There is a time of use charge for consumers with contract demand of 500 kVA and above. They have to pay an additional charge of Rs 0.75 per kWh consumed during the two peak periods, defined as 07.00 hours to 11.00 hours in the morning and 17.00 hours to 21.00 hours in the evening. Further, for consumers with a contract demand of 1000 kVA and above, a surcharge ranging from Rs. 0.14 per kWh to Rs. 0.18 per kWh is applicable. The tariff structure has a provision for a fuel cost adjustment clause to reflect the increase in the cost of fuel. There is a special tariff in respect of consumers receiving power at high tension for the purpose of operating induction furnaces.

Commercial Tariff: For large commercial consumers contracting for 100 kVA and above, the demand charge is Rs. 125 per kVA of billing demand for the first 1000 kVA and Rs. 175 per kVA for the balance kVA of billing demand. The energy charge is Rs. 1.80 per kWh. The time of use charge, the surcharge and the fuel adjustment clause are same as that applicable for the industrial consumers.

Residential Tariff: For residential supply the fixed charge is Rs. 3.00 month for consumption up to first 100 kWh and Rs. 4.00 month for consumption exceeding 100 kWh. The energy charge is graduated and increases as the consumption increases. It ranges from Rs. 0.36 per kWh for consumption of the first 10 kWh to Rs. 0.88 per kWh for consumption up to 100 kWh per month. For consumption between 100 kWh to 250 kWh, the energy charge varies from Rs. 0.68 per kWh for the first 50 kWh to Rs. 1.28 per kWh for the last 50 kWh. For consumption beyond 250 kWh, the energy charge varies from Rs. 0.78 per kWh for the first 50 units to Rs. 1.87 per kWh for all units beyond 450 kWh. The tariff structure has a provision for a fuel cost adjustment clause to reflect the increase in the cost of fuel.

Agricultural Tariff: For agricultural consumers with meters, the tariff is Rs. 0.50 per kWh as energy charge. There is no fixed charge. Agricultural consumers without meters are billed on the basis of rating (HP) of their irrigation pumps. For pumps with a rating up to 7.5 HP, the consumer has to pay Rs. 350/HP/annum and for consumers with pumps of rating higher than 7.5 HP, the charge is Rs. 600/HP/annum.

Financial Performance

The working results of the Board for the financial year 1996-97, which are based on the annual statement of accounts are depicted in Table 3.4. As per Section 59 of the Electricity (Supply) Act, 1948, all SEBs are required to generate a surplus of a minimum of three per cent of the value of the fixed assets of the Board in service at the beginning of the year. GEB could generate surplus of 3% only after receiving substantial subsidies from the State Government, which accounted for over 20% of GEB's total income.

Table 2.4: Working results of GEB (Rs. million)

S. No	Particulars	1995-96	1996-97
INCOME			
1.	Sale of Power	33788.6	43196.5
2.	Other Income	1017.7	1625.3
3.	Grants received for R&D	3.9	2.0
4.	Agriculture and other subsidies	11111.0	11793.8
	TOTAL INCOME	45920.2	56617.6
EXPENDITURE			
1.	Generation of power	20149.2	23132.1
2.	Bulk purchase of power	10588.7	14920.3
3.	Salaries, wages and administrative charges	2853.2	3777.9
4.	Other Operation and Maintenance expenses	1868.1	1983.4
5.	Depreciation	4031.7	4439.9
6.	Interest and Finance charges	5646.2	6083.7
7.	Expenses carried over from past period	(296.9)	1181.3
	TOTAL EXPENDITURE	44840.2	55518.6
	Surplus	1080.0	1099.0

2.3 RESTRUCTURING OF THE ELECTRICITY INDUSTRY IN GUJARAT

The state of Gujarat has initiated an exercise to restructure the electricity business. The driving forces for initiating the restructuring are to improve the operational performance and financial viability, enhance economic efficiency, promote participation of private capital, and to ensure better service to the customers.

The exercise has been initiated with the assistance of Asian Development Bank (ADB) and involves studying alternative models for reorganising the industry and evolving consensus on a model best suited to particular needs of Gujarat. TERI has been appointed as the lead consultant by the ADB for this project. The project is currently in an advanced stage and TERI is working with a consortium of international consultants on various aspects of the restructuring exercise.

CHAPTER 3

CONTRACTUAL ARRANGEMENTS FOR SALE OF GAS

3.1 INTRODUCTION

Bulk of natural gas is produced in the country today by the two national oil companies, namely, Oil & Natural Gas Corporation (ONGC) and Oil India Limited (OIL). Initially, these two companies made direct sales of natural gas to all customers including some small local distribution companies who were catering to local residential, commercial and small industrial consumers. At the time of laying the inter-state Hazira - Bijaipur - Jagdishpur (HBJ) pipeline, the Gas Authority of India Limited (GAIL) was formed in the Public Sector in 1984 and charged with management and operation of the HBJ pipeline and sales to customers situated along this pipeline. GAIL was to receive a transportation charge as determined by the Government of India (GOI). As a result of this arrangement, while GAIL purchased natural gas from ONGC at Hazira and sold it to customers along the HBJ pipeline, natural gas continued to be sold elsewhere in the country by ONGC & OIL as before.

This arrangement was changed following the decision of GOI to transfer all marketing functions for natural gas from ONGC to GAIL. GAIL took over the marketing functions from ONGC all over the country from May 1992.

3.2 RELATIONSHIP BETWEEN ONGC & GAIL

Some of the relevant points of understanding between ONGC & GAIL are as below: -

- (i) Gas is transferred to GAIL at the fence of ONGC installation (i.e. Gas Collecting Stations and/or gas treatment and processing plants). All assets of ONGC beyond the transfer points were transferred to GAIL at the book value.
- (ii) As regards the price, ONGC and OIL mutually negotiated prices with customers before 1987. However, in January 1987, the Government fixed a three tier price that was to be applicable to all consumers:-
 - Rs. 1400/MMCM at landfall points plus transportation charge of Rs. 850/MMCM to customers along the inter-state HBJ pipeline.
 - Rs. 1400/MMCM at other areas excepting in the North-eastern Region.
 - Rs. 1000/MMCM in the North-eastern Region with maximum discount of Rs. 500/MMCM for each case on merit.

The price regime was changed with effect from January 1, 1992. A distinction was now made between the producer price payable to ONGC which was fixed at Rs. 1500/MMCM and the consumer price which was to start at Rs. 1550/MMCM and increase by Rs. 100/MMCM annually up to Rs. 1850/MMCM. The difference between producer price and consumer price was credited to a "gas pool account". The transportation charge of Rs. 850/MMCM along the HBJ line remained unchanged. The concessional price for the North-east was retained but the discount was reduced to Rs 400/MMCM.

- (iii) This changed dramatically from October 1, 1997. Natural gas prices at the landfall point now are linked to a basket of fuel oils traded internationally. At present, the price is set for every quarter and is 65% of the average price of the specified fuel oils in the last quarter (\$ 1.36/MMBtu). This parity is scheduled to increase to 75% in 1999/2000. However, in the North-eastern part of the country concessions would still apply with the gas price parity with fuel oils being currently at 40% and likely to increase to 45% in the next year. This price is linked to a calorific value of 10000 kcal/Nm³. The transportation charge payable to GAIL along the HBJ pipeline is set at Rs. 1150/MMCM (\$ 0.76/MMBtu), and will increase by 1% for every 10% increase in the consumer price index. The increase due to the price indexing however, will be paid out of a Gas Pool account. The transportation charge will be linked to a calorific value of 8500 kcal/ Nm³.

GAIL is expected to pay ONGC and OIL on a netback basis the proceeds of sales of gas supplied by them, after making appropriate deductions for the higher price it will pay for gas purchased from joint venture companies, and for its contributions to the Gas Pool Account.

- (iv) A review will be undertaken in 2000 with a view to achieving 100% fuel oil parity.
- (v) This understanding also spells out the specifications of the gas to be supplied including the calorific value and gas pressure, planned monthly system of billing, etc.
- (vi) As all these companies are in the Public Sector, the resolution of disputes has been done informally through the intervention of the Ministry of Petroleum and Natural Gas.

3.2.1 Private Gas Producers

GOI has awarded medium and small-sized fields for development through the joint sector and the private sector respectively. The small field developers have been given the freedom to select their customers and sell gas at negotiated prices. Gas from the medium sized fields has to be sold to GAIL and the price paid by GAIL is

linked to international prices of fuel oil. While the relationship between GAIL and ONGC is non-contractual, the contracts between GAIL and joint sector producers are very detailed with explicit provisions for take or pay, penalties for failure to supply, force-majeure, arbitration etc.

3.3 CONTRACTS BETWEEN GAIL AND CUSTOMERS

GAIL has assumed responsibility for all the existing contracts in respect of customers taken over from ONGC. However, in respect of ONGC's erstwhile customers on the HBJ and the new customers with whom supplies are being contracted by GAIL, a standard contract has been evolved with case-specific small variations. The major points covered in such contracts are: -

- (i) *Period of contract:* The period is between 10 and 15 years from the date of commencement of supply.
- (ii) *Activity milestones for new customers:* The contract spells out the dates of completion of major activities for new plants like purchase of land, ordering of equipment, commencement of construction, completion of construction, etc. The contract requires all purchasers to lodge with GAIL a refundable cash deposit and a bank guarantee (equivalent to about three times the cash deposit). GAIL is required to pay interest on the cash deposit. The contract also stipulates that GAIL has the right to forfeit 25% of the bank guarantee for delay in completion of any of the stipulated major activities in a new plant beyond three months of the milestone schedule. The right of GAIL to cancel the contract for further delays in construction activities is also incorporated in the contract.
- (iii) *Manner of delivery of gas:* The inlet pressures, location of the Gas Metering Station, its installation and maintenance by the seller at the consumer's cost and provision of a check metering station by the consumer, are provided in the contract. Besides, frequency and method of calibration of metering unit are specified.
- (iv) *Quantity of gas:* The progressive schedule of delivery is indicated in the contract in terms of daily quantity. However, prior to each contract year the customer is required to indicate a forecast of gas requirement. The customer guarantees a minimum off-take of around 80% of the contracted quantity and payments being made up to this 80% level even when the offtakes are lower (take or pay).
- (v) *Specification of gas:* The quality of gas to be supplied and the method to be followed for gas sampling is annotated. Typical limits of composition of the gas at the delivery point are indicated.

- (vi) *Price of gas:* This is as decided by the GOI in its price notification that is issued periodically. In addition transportation charges, royalty, taxes, duties and other statutory levies of the Central/State Government or any other local bodies are borne by the buyer.
- (vii) *Transport cost:* This is either a fixed amount as for delivery ex-HBJ pipeline or according to a formula, where a new gas line is laid for making supplies of gas available to a consumer. In respect of existing customers outside the HBJ pipeline, the transfer charges as earlier agreed mutually between the supplier and consumer will continue. However, for future the new formula will be relevant. This formula covers annual depreciation of pipeline cost, reasonable return on capital cost of the pipeline and its operation and maintenance costs. The transport cost is subject to escalation at 3% per annum.
- (viii) *Billing and payment terms:* Invoices are submitted fortnightly and customers are to pay within 3 working days of presentation of an invoice. The customer has to open and maintain an irrevocable Letter of Credit with a bank notified by the seller, covering a value of fifteen days supply of gas at maximum contracted quantity and the monthly transportation charge. If, for any reason, payment is delayed or any disallowance made from the invoice, the seller may present the invoice for the full amount or for the amount not paid, as the case may be, to the bank against the Letter of Credit and draw the amount, in which case the customer has to make arrangements with the bank the full amount of L/C to be automatically reinstated.
- (ix) *Arbitration:* This is generally guided by the provisions of Indian Arbitration Act. Besides, other Indian Laws relating to contract, etc. are fully applicable.

There may be small variations from the above contours of a contract, which are specific to individual customers. GAIL's contracts with consumers have been criticised as being one-sided. While GAIL is protected by take-or-pay provisions, there is no penalty on GAIL for short-supply.

3.3.1 Issues

Some of the important points in respect of these contracts between different parties are elaborated below. First, different prices prevail at different locations depending on the transportation cost and sales tax, but no distinction is made currently between different categories of consumers in the same location with reference to the opportunity value of gas they use or the end-use. Also, a fertiliser or a power plant along the HBJ pipeline pays a price higher by at least Rs. 1150/MMCM than the price paid by its counterpart located at Hazira or near other landfall points/onshore producing fields. There obviously is a trade-off between transporting natural gas and transportation cost of the final product emanating from these plants. Present users of

gas at different pipeline locations believe themselves to be inequitably placed as far as these trade-offs are concerned.

Second, supplies of gas to all categories are non-interruptible, except for those delivered to "fall-back" customers. Currently to avoid under-utilisation of available gas, allocations are made in excess of the availability. Some of the consumers are allocated gas and, in some cases, some of the allocations made to a consumer are in this "fall-back" category. Gas supply on this account may be fully or partially terminated depending upon availability. Some small industrial consumers fall within this category, together with volumes of gas used as fuel (as distinct from gas to be used as feedstock) in the fertiliser plants, the contracts specifically providing for such interruptibility. While dual-fuel arrangements were made only as exceptions, now the Government is insisting on dual fuel arrangements for new customers who are being allocated gas

Third, GAIL today discharges the role of both a transporter and a merchant. The current capacity of pipelines is by and large the same as the commitment of supply to consumers already allocated gas along these pipelines. New users of gas for whom new lines would be laid are thus required to pay to GAIL a transportation charge based on new capital and O&M costs. The possibility of disputes associated with such new charges cannot be ruled out.

Finally, the issue of gas storage required with reference to seasonal or daily variations in gas demand experienced in respect of power stations has not been resolved. These variations may best be handled by gas storage or by other forms of demand management. No formal arrangement has, as yet, emerged in this regard.

3.4 CONTRACTS WITH LOCAL DISTRIBUTING COMPANIES

Contracts were signed with Baroda Municipal Corporation and Gujarat Gas Company in Gujarat and with Assam Gas Company in Assam for distribution of gas through their network. The conditions for supply of gas by ONGC, GAIL or OIL, as the case may be, are by and large the same, and at prices within the framework, as indicated earlier. The prices charged by the local distributing companies are not subject to Government control. These are freely negotiated between the buyers and the sellers and are by and large linked to prices of alternative fuels.

3.5 EXPECTATIONS FOR THE FUTURE

The Government of India has completed a study of the options for a regulatory framework for the gas industry. It is likely that an independent regulatory body will be established with statutory powers. The Government is finalising new policy guidelines for the natural gas sector, with licensing for all transmission/distribution projects, and the proposed regulatory body being empowered to decide pipeline route, capacity,

and facilitate establishment of tariff levels. The regulator will have the powers to settle disputes relating to pipeline tariff but is not expected to fix the price of gas. The price of gas; domestic and imported; will be determined by the market. This apart, it is considering having open-access system of gas transportation, but appears to be in favour of some provisions for unbundling of services. The largely informal setup at present is likely to change in favour of contractual relations. The consumers have accepted fluctuating gas prices linked to fuel oil prices. They are likely to accept the provisions, which characterise gas contracts in western countries. However, they will expect the contracts to be balanced with penalties on both contracting parties for non-fulfilment of terms and conditions.

The contract between the seller and the buyer may be governed by Indian law or if the parties so agree, by any other law. The parties will also be free to choose the rules of arbitration.

CHAPTER 4

PRICE STRUCTURE OF FUELS

4.1 INTRODUCTION

The general pricing regime prevalent in India is primarily governed by the Central Government, with allowances for levying of state level duties and charges. This is a legacy of the administered pricing mechanism that is yet to be completely dismantled. This section provides the price build up for various fuels, with specific reference to Gujarat.

4.2 COAL

4.2.1 Domestic coal

Domestic coal is sold in Gujarat mainly to the power stations and it includes all central and state level charges.

The basic price build up for coal is as follows:

- **Pithead price** is the price at the coal mine
- **Internal transport** - When the loading point of coal is beyond 3 km, the coal companies charge the additional transport costs at the following rates:

3-10 km	Rs 21 per ton
10-20 km	Rs 40 per ton

In most cases it is the first distance slab which is applicable.

- **Sizing charges:** These charges are levied to limit the size of coal within 200-250 mm range.
- **Royalty:** It is levied by the state government where coal is extracted.
- **Duties:** a stowing excise duty is levied on all coal. It covers the cost of stowing sand or other material in the void created by underground mining.
- **Central sales tax** is collected by the Government at a fixed rate of 4%
- **Transport charges from loading point to ultimate destination** have to be paid by the consumer depending upon the mode of transport and the distance involved.

Bulk of the coal supply in Gujarat is from the South Eastern Coalfields Limited (SECL) in Madhya Pradesh. Western Coal fields (WCL) in Maharashtra and Mahanadi Coalfield (MCL) in Orissa also supply coal to this state. This is non-coking coal used for power generation. The price notification of the Ministry of Coal specifies the rates for coal from SECL, WCL and MCL and is given in Table 4.1.

Table 4.1: Coal pricing at pithead

Type of coal	Grade	Coal from SECL		Coal from WCL		Coal from MCL	
		Rs/t	\$/t*	Rs/t	\$/t*	Rs/t	\$/t*
Long Flame Coal							
	A	924	22.0	996	24.0	888	21.1
	B	836	19.9	940	22.0	803	19.1
	C	698	16.6	855	20.0	671	16.0
	D	584	13.9	814	19.0	564	13.4
Non-long Flame Coal							
	A	864	20.6	936	22.0	828	19.7
	B	776	18.5	880	21.0	743	17.7
	C	638	15.2	795	18.9	611	14.5
	D	524	12.5	754	17.9	504	12.0
	E	416	9.9	627	14.9	400	9.5
	F	332	7.9	523	12.4	319	7.6
	G	237	5.6	394	9.4	227	5.4

* Assuming an exchange rate of 42 Rs. : 1 \$

Note: The grading of coal is representative of its quality. Long flame coal is defined by certain parameters of volatile matter, moisture and gross calorific value. The grading of coal based on the calorific value (useful heat value in kcal/kg) is as under:

Grade A: > 6200; **Grade B:** 5600-6200; **Grade C:** 4940-5600; **Grade D:** 4200-4940; **Grade E:** 3360-4200; **Grade F:** 2400-3360; **Grade G:** 1300-2400.

The price of "Grade D" non-coking coal has been deregulated since February 1997. Also prices of lower grade non-coking coals (power grade E, F and G) can be revised once every six months till the year 2000. After that point in time prices of these grades will be fixed in relation to the market prices. Distribution of these coals will also be deregulated from January 1, 2000.

A typical price build-up for coal sold in Gujarat by SECL is shown in Table 4.2.

Table 4.2: Price build-up for coal sold at Gandhinagar from SECL (Rs./t)

Price head	Grade E	Grade F	Grade G
Pit-head price	416	332	227
Internal transport	21	21	21
Sizing charge	20	20	20
Royalty	70	50	50
Stowing excise duty	3.50	3.50	3.50
Central sales tax (@ 4%)	21	17	13
Sub-Total	551	444	334
Rail Freight	893	893	893
Total	1444	1337	1227

In addition, rail transport charges are required to be paid by the consumers. The rail tariff is related to the distance slabs, and the typical distance between mines at SECL is about 1400 km to Gandhinagar, whereas the distance from MCL is about 1600 km to the same destination. The rail freight rates for moving coal for these distance slabs are Rs. 893/t and Rs.1065/t respectively. Hence a power plant at Gandhinagar receiving coal from SECL pays prices in the range Rs. 1399/t to Rs. 1616/t, depending on the grade of coal it receives. This corresponds to \$ 33 - 38 per ton range.

4.3 PETROLEUM PRODUCTS

The prices of petroleum products have been selectively deregulated. The Gazette notification of 21st November 1997 details the phasing of dismantling program of the administered pricing mechanism and the duty structure for the terminal year 2001-02. According to the notification, prices of petroleum products at the refinery gate will move towards import parity by year 2001-02. For the existing refineries, controlled products viz. LPG, gasoline, kerosene, jet fuel, and gas oil will be fixed at adjusted import parity prices during the transition period. The prices of LPG, gasoline, kerosene and jet fuel will move towards import parity in a phased manner, while the ex-storage price of gas oil is currently linked to import parity. The prices for the controlled products will be fixed by the Oil Co-ordination Committee (OCC).

The price build up for various petroleum products is shown in Table 4.3. These prices are at the refinery gate of Indian Oil Corporation at Koyali (Baroda).

Table 4.3: Prices of petroleum products, ex-Koyali, as on 6th August 1998

Product	Basic rate	State surcharge	Sub-total	Excise duty	Sales tax	Total
LPG (Rs/t)	9000	150	9150	915	1510	11575 (276)
Naphtha (Rs/t)	6820	110	6930	1040	1594	9563 (228)
Gas oil (Rs/kl)	7537	134	7671	-	1657	9328 (222)
LDO (Rs/kl)	7010	80	7090	1063	652	8805 (210)
Furnace Oil (Rs/kl)	4670	109	4779	717	660	6156 (147)
LSHS (Rs/kl)	5010	114	5124	769	884	6777 (161)

Note: Figures in parentheses are in \$ per ton or kl as the case may be.

The state sales tax applicable (on the total of basic rate, state surcharge and excise duty) in Gujarat on different products is given in Table 4.4.

Table 4.4: Gujarat state sales tax

Product	Rate (%)
LPG	15.0
Naphtha	20.0
Gas oil	21.6
LDO	8.0
Furnace Oil	12.0
LSHS	15.0

In addition, the consumer pays the transportation charges, depending on the mode of transportation employed and the distance covered.

4.4 NATURAL GAS PRICES

The price of natural gas has been linked to fuel oil prices since October 1, 1997. The price would be determined and notified by GAIL for every quarter, and will be linked to the average price of the basket of fuel oils in the previous quarter. The general price would vary between a floor of Rs. 2150/MMCM and a ceiling of Rs. 2850/MMCM. The range for the North-eastern states would be Rs. 1200-1700/MMCM. This gas price is linked to a calorific value of 10000 kcal/Nm³. The consumer price will be reviewed in 2000 with a view to moving towards full parity with fuel oil prices. The transportation charge payable to GAIL is fixed at Rs. 1150/MMCM, and is linked to a calorific value of 8500 kcal/ Nm³. There is also a provision for increasing the price of gas by 1% for every 10% increase in the consumer price index, the increase however, would not be borne by the consumer. In addition royalty, taxes and other duties will apply.

In the case of gas transported by the HBJ pipeline, the price of natural gas at the landfall point (Hazira) is Rs. 2271/MMCM. In addition there is a transportation charge of Rs. 1150/MMCM for the consumers along the HBJ pipeline. Other charges include a royalty of 10% and a Gujarat state sales tax of 19%. A typical price build up for NTPC, Kawas, which is a consumer on the HBJ pipeline, is shown in Table 4.5.

Table 4.5: Price of gas for NTPC Kawas (for the quarter April - June 1998)

Item	Rs/MMCM	\$/MMBtu
Landfall/onshore gas price	2271	1.36
Royalty	227	0.13
Transport charge	1150	0.81
State sales tax (@ 19%)	693	0.45
Total	4341	2.75

The prices charged by the local distributing companies, such as Gujarat Gas Company and Baroda Municipal Corporation are mutually negotiated prices.

CHAPTER 5

THE POWER AND INDUSTRIAL SECTORS

5.1 THE POWER SECTOR

A major share of Gujarat's generating capacity is based on fossil fuels, namely coal, lignite, natural gas, and liquid petroleum fuels like naphtha, NGL and fuel oil. Though the state has nuclear and hydro-based generating capacity, their share in the total installed capacity is small. Table 5.1 lists the existing power stations in Gujarat, along with ownership, capacity, and fuel.

Table 5.1: Power stations in Gujarat

S. No.	Location	Ownership	Capacity (MW)	Fuel
1.	Paguthan	GTEC	655	Gas/Naphtha
2.	Kawas	NTPC	655	Gas/Naphtha
3.	Gandhar	NTPC	650	Gas
4.	Hazira	Essar Power	515	Gas/Naphtha
5.	Baroda	GIPCL	305	Gas/Naphtha
6.	Utran	GEB	135	Gas
7.	Vatva	AEC	100	Gas
8.	Dhuvaran	GEB	54	Gas
9.	Utran	GEB	45	Gas (Steam)
10.	Dhuvaran	GEB	534	RFO (Steam)
11.	Wanakbori	GEB	1260	Coal
12.	Ukai	GEB	850	Coal
13.	Gandhinagar	GEB	660	Coal
14.	Sabarmati	AEC	410	Coal
15.	Sikka	GEB	240	Coal
16.	Kutch	GEB	215	Lignite
17.	Ukai	GEB	305	Hydro
18.	Kadana	GEB	120	Hydro
19.	Panam	GEB	2	Hydro
20.	Kakrapar	NPC	440	Nuclear

Of the thermal plants, the majority have steam turbines installed, and use coal and lignite as fuel. Gujarat Electricity Board's (GEB) plants at Utran and Dhuvaran use natural gas and residual fuel oil respectively to generate steam.

All the other thermal plants have gas turbines installed, and of these, all except Dhuvaran, run in combined cycle mode. Dhuvaran has two gas turbines of 27 MW each, which are used for peaking requirements.

Natural gas supplies to the power stations are strictly rationed, and none of the combined cycle gas turbines (CCGT) stations get their full requirement of gas.

The description of power stations using natural or liquid fuels for power generation follows, and is given according to ownership. Only the facilities using gas or petroleum products have been covered here, as these would be the potential customers for regassified LNG.

5.1.1 National Thermal Power Corporation

The National Thermal Power Corporation (NTPC) has two power stations located in Gujarat, a 650 MW combined cycle station at Gandhar near Bharuch, and another of 655 MW capacity at Kawas near Hazira. The Gandhar and Kawas stations together have a total potential gas demand of 2061 MMCM/year. Both plants are planning to double their existing capacity, and by 2001-02, the gas demand is expected to reach 4122 MMCM/year.

Gandhar

The Gandhar station has three gas turbines of 141 MW capacity each and one steam turbine of 225 MW capacity. The plant has an allocation of 1.5 MMSCMD of natural gas from the HBJ pipeline. At present, the plant is not using any liquid fuel to offset the shortage in supply of gas. As a result, only two gas turbines are operated, and those too at plant load factors (PLF) of less than 50%.

NTPC has entered into a fuel supply agreement (FSA) for naphtha with the Indian Oil Corporation (IOC), and will be supplied naphtha through a 12 km pipeline from Nabipur (near Bharuch), where provision is being made to receive and store naphtha through railway tank wagons.

NTPC plans to double the capacity of the station using a configuration similar to that existing. The additional capacity is expected to be in commercial operation by the year 2001. Naphtha from IOC will be the primary fuel for the expansion.

Kawas

At Kawas, NTPC has four gas turbines of 106 MW capacity each and two steam turbines of 116 MW each. Their firm allocation from the HBJ pipeline is 2.25 MMSCMD of natural gas, but of late, there have been increasing incidences of non-supply of gas.

Keeping in mind the unpredictable gas supplies, the station started using NGL/Naphtha from Oil and Natural gas Corporation (ONGC), Hazira on Hindustan Petroleum Corporation Limited's (HPCL) account. All the four gas turbines were fired on liquid fuels in end-1997. NTPC Kawas has only about three days of storage available for NGL/Naphtha, and face problems in the operation of the station on this account.

NTPC Kawas is also planning to double its capacity by the year 2001-02. At present, the bids for land development are under evaluation. NTPC has signed a fuel supply agreement for naphtha with IOC for the new capacity.

5.1.2 Ahmedabad Electricity Company

The Ahmedabad Electricity Company (AEC) owns one CCGT station at Vatva near Ahmedabad. The total capacity is 100 MW. Their current allocation from the North Gujarat Gas Distribution Network of Gas Authority of India (GAIL) is 0.40 MMSCMD. This allocation does not cover their entire requirement and they are using gas oil as a supplementary fuel. AEC has already been allocated naphtha linkage, and as soon as facilities for receiving naphtha are in place, the plant will start using naphtha instead of gas oil to supplement natural gas.

A new power plant of 150 MW capacity using naphtha as fuel and CCGT technology, is planned at Vatva. AEC expects to commission the plant by the year 2001.

AEC's existing plant at Vatva has a potential demand of 130 MMCM/year, and once the new plant is commissioned, the gas demand is expected to go up to 325 MMCM/year.

5.1.3 Gujarat Torrent Energy Corporation

Gujarat Torrent Energy Corporation (GTEC) has partially commissioned its 655 MW CCGT plant at Paguthan near Bharuch, and will be commencing full operations by October 1998. Three gas turbines of capacity 135 MW each and a steam turbine of capacity 250 MW are installed at the facility. GAIL has allocated 1.50 MMSCMD of gas from the South Gujarat (on-shore) network for the plant, but as this does not cover the complete requirements, GTEC have also entered into a FSA with IOC for supply of naphtha. A railway siding has been constructed at Nabipur and a pipeline laid over a distance of 8 km from the railway siding to the plant.

GTEC has already received the preliminary clearances for the expansion of the Paguthan facilities by another 655 MW. They are waiting for the fuel linkages to be finalised, and expect to commission the plant within three years of signing the fuel supply agreement.

The Paguthan plant of GTEC can potentially use a total of 1052 MMCM/year of gas at present, and this demand is expected to double to 2104 MMCM/year by 2001-02.

5.1.4 Essar Power Company

Essar Power's Hazira CCGT plant claims to be the first independent power producer (IPP) to commence operations in India. Total installed capacity at the facility is 515 MW, comprising of three 110 MW each gas turbines and a 185 MW steam turbine. Of the 515 MW, 215 MW are earmarked for supply to the neighbouring Essar Steel complex, and 300 MW are supplied to the Gujarat Electricity Board.

The plant primarily uses NGL/Naphtha as fuel, but is also supplied natural gas if the Essar Steel facility has any spare supplies. The gas turbines have been configured for mixed fuel firing and both gas and liquid fuels can be used simultaneously. The range is from 15% gas and 85% NGL/Naphtha, to 85% gas and 15% NGL/Naphtha. The NGL/Naphtha is supplied by ONGC on IOC's account.

In 1997-98, the facility recorded a PLF of about 85% and availability of 96%.

Essar plans to double the capacity of the plant by adding an identical 515 MW module. At present, the EPC bids are being evaluated. The power purchase agreement (PPA) with GEB is still pending. The PPA is required to be signed before the Central Electricity Authority (CEA) can give the techno-economic clearance (TEC). The PPA and the TEC, along with financial closure is expected to take about a year. Essar plans to commission the first gas turbine within eighteen months of achieving financial closure.

Essar Power currently has a total potential gas demand of 818 MMCM/year, which is expected to double to 1636 MMCM/year by 2001-02.

5.1.5 Gujarat Industries Power Company Limited

The Gujarat Industries Power Company Limited (GIPCL) has one 305 MW CCGT plant in operation near Baroda, and another plant based on CFBC technology and fuelled on lignite is under construction at Mangrol near Bharuch.

At present, GIPCL has separate fuel supply agreements with GAIL for supply of gas, and IOC for supply of naphtha. The plant achieved a PLF of greater than 89% in 1997-98.

GIPCL plans to put up another 160 MW of capacity at Baroda, and have space available for the same. They are currently waiting for the fuel linkages to be finalised.

GIPCL Baroda has a total potential gas demand of 397 MMCM/year at present, which is expected to increase to 605 MMCM/year once their capacity addition is complete.

5.1.6 Gujarat Electricity Board

The generating stations owned by GEB are primarily coal-fired steam turbines. The only gas turbines under GEB ownership are at Utran (135 MW) and Dhuvaran (54 MW). Besides, GEB also has 45 MW of gas fired steam turbine capacity at Utran and 534 MW of RFO fired steam turbines at Dhuvaran.

At Dhuvaran, there were originally four gas turbines, of which two have already been decommissioned. The remaining two gas turbines are also slated to be taken out of service, and new turbines having a total capacity of 110 MW installed as replacement. GEB plans on completing this by 2001-02. At Utran, GEB has plans to add another 135 MW GT capacity by the year 2006-07.

Currently, GEB has a total potential gas demand (RFO and gas fired steam turbines, and gas turbines) of 1462 MMCM/year. With the renovation of the gas turbines at Dhuvaran, total demand is expected to reach 1534 MMCM/year by 2001-02. Further, GEB also plans to expand the capacity at Utran by 2006-07, and once this is through, the total gas demand is expected to be 1710 MMCM/year.

5.2 THE INDUSTRIAL SECTOR

The state of Gujarat is highly industrialised with the manufacturing sector accounting for approximately 35% of the net state domestic product. The state has witnessed a steady stream of investments in recent years with the manufacturing sector absorbing approximately 58% of the total investments received in 1997.

5.2.1 The Fertiliser Sector

Gujarat has six fertiliser plants, manufacturing both nitrogenous and phosphatic fertilisers. There are four plants manufacturing ammonia and urea, and all are located in Southern Gujarat. The two plants making phosphatic fertilisers are located near the port town of Kandla.

Gujarat State Fertilizers & Chemicals

Gujarat State Fertilizers & Chemicals (GSFC) produces ammonia and urea at its plant located near Baroda. The current installed capacity is for manufacture of 950 MT of ammonia per day. A new ammonia plant of 1350 tpd capacity is under commissioning. Once the new ammonia plant is stabilised, GSFC plans to shut down the old plant and carry out renovation and modernisation work on it. After renovation, the ammonia plant will be brought on-stream subject to fuel (feedstock) supply agreements being signed.

GSFC gets its gas supplies through GAIL's South Gujarat distribution network from Ankleswar, and also from the HBJ pipeline. In addition they use naphtha to cover the shortfall in gas supplies and have a FSA with IOC. Also LSHS is used in their steam boilers. Both LSHS and naphtha are supplied from Gujarat Refinery through a

pipeline. In recent times, gas supplies from Ankleswar have been falling off, and GSFC has been forced to rely more on naphtha.

The current gas demand at GSFC is 282 MMCM/year, which is expected to increase to 400 MMCM/year with the commissioning of the new ammonia plant by 1999.

Krishak Bharti Co-operative

The Krishak Bharti Co-operative (KRIBHCO) has a facility at Hazira for manufacturing 2700 tpd of ammonia. By running the facility at 120% load factor, they are able to achieve a production of about 3200 tpd. KRIBHCO has two steam turbines of 30 MW capacity each, for captive power generation. Currently they are using NGL/Naphtha to fire the steam boilers.

A new ammonia unit of capacity 1350 tpd is planned to be put up, in addition to another steam turbine of about 13 MW capacity. This expansion should be complete in the next two to three years.

At present they are supplied with 3.0 MMSCMD of natural gas along with 0.2 MMTPA of NGL/Naphtha.

The total potential gas demand at KRIBHCO Hazira, for both the ammonia plant and the captive power plant, is 1076 MMCM/year. This is expected to increase to a total of 1505 MMCM/year by 2001-02.

Gujarat Narmada Fertiliser Company

Gujarat Narmada Fertiliser Company (GNFC), Bharuch, is a joint-sector venture, with equity being held by the GSFC, the Gujarat government, and foreign and Indian financial institutions. At present they have a 1600 tpd ammonia making plant. They plan to put up a new unit of 1350 tpd capacity in the next three years. GNFC also has captive generation capacity comprising of two 25 MW steam turbines which use coal for steam generation.

GNFC uses LSHS and RFO for the production of ammonia and natural gas for making methanol.

GNFC has a total potential gas demand of 877 MMCM/year at present. This demand is inclusive of the requirements in their ammonia plant, the captive power plant, and the methanol manufacturing plant. By 2001-02, with the commissioning of an additional ammonia plant, the total gas demand is expected to be 1278 MMCM/year.

Indian Farmers Fertilisers Co-operative

Indian Farmers Fertilisers Co-operative (IFFCO) has a plant at Kalol near Ahmedabad. This facility is yet to be visited by TERI.

5.2.2 Petrochemicals

Gujarat has two of the largest petrochemical complexes in India, Indian Petrochemicals Corporation Limited (IPCL) and Reliance Industries Limited (RIL). As the products manufactured at the petrochemical facilities need C_2/C_3 compounds in the feedstock, regassified LNG, which is expected to primarily contain methane (up to 98%), is ruled out for use as feedstock. However, the facilities have installed a significant amount of captive generation capacity in the form of gas turbines, for which regassified LNG could be used as fuel.

Indian Petrochemicals Corporation Limited

IPCL has a naphtha cracker installed at their existing facilities near Baroda. Besides naphtha, kerosene and LPG are also used as feedstock, all sourced from Gujarat Refinery. Kerosene is used to extract n-paraffin, while LPG yields propylene. In both the cases, the return stream is sent back to the refinery.

IPCL, Baroda has 65 MW of gas turbine capacity for captive power generation. The turbines are run in open cycle mode and the waste heat is recovered for process heating. At present, they have an allocation of 0.90 MMSCMD of gas from the HBJ pipeline system.

IPCL has also constructed another facility near Dahej, known as IPCL, Gandhar. This facility is under commissioning and should be starting commercial operation in the first half of 1999. A gas cracker has been installed at IPCL, Gandhar. Natural gas will be supplied from the Hazira facilities of the Oil and Natural Gas Corporation (ONGC) through a pipeline. IPCL, after extracting C_2/C_3 compounds, will return lean gas to ONGC for onward transmission through the HBJ pipeline. The gross input requirement of rich gas is 8 MMSCMD.

Naphtha fired gas turbines in combined cycle mode, with a total capacity of 100 MW already exist at the IPCL, Gandhar facility. Larsen & Toubro (L&T) are adding another 90 MW under a Build-Own-Operate-Transfer (BOOT) arrangement.

IPCL has a total potential gas demand of 253 MMCM/year at present, in their captive power plants at Baroda and Dahej. With the commissioning of the additional generating capacity at Dahej, this demand is expected to increase to 370 MMCM/year.

Reliance Industries Limited

Reliance Industries have a very large petrochemical complex in operation at Hazira. A naphtha cracker is installed at the facility and Reliance import naphtha through a single buoy mooring (SBM) at Hazira.

The Hazira plant has a total of 260 MW of captive generation capacity. There are seven gas turbines of 31 MW capacity each and one steam turbine of 45 MW capacity. At present, both natural gas and NGL/Naphtha are used for power generation.

Reliance Industries have a total potential gas demand of 377 MMCM/year for use in their captive power plant at Hazira.

5.2.3 Other Industries

Besides the industrial sectors mentioned above, Gujarat also has other industries which require natural gas as process input or for captive power generation. A sponge iron unit and a refinery are located in Gujarat. There are a number of cement units that could possibly use natural gas.

The industries that have already been visited are described below.

Essar Steel Limited:

Essar Steel has an integrated steel plant at Hazira that incorporates a sponge iron unit. They require 2 MMSCMD of natural gas in their Midrex Furnaces, which is being supplied by GAIL through the South Gujarat network. An additional amount of 0.50 MMSCMD gas is required by them for use in the reheating furnaces.

Also, the Essar Steel complex houses a captive power plant of 30 MW capacity using gas turbines in open cycle mode.

Essar steel is using gas in the Midrex Furnaces, reheating furnaces, and the captive power plant. Their total potential gas demand is 970 MMCM/year.

Gujarat Refinery:

The Gujarat Refinery is owned by the Indian Oil Corporation, and is located in Koyali near Baroda. The refinery has two gas turbines of 30 MW each, which are run in open cycle mode with waste heat being recovered for use in the process. Another 30 MW GT is expected to be installed by the year 2000.

At present, Gujarat Refinery has been allocated 0.40 MSCMD gas from GAIL. Due to shortfall in supplies, they are forced to use gas oil as a supplementary fuel in the gas turbines.

Gujarat Refinery has a total potential gas demand of 114 MMCM/year at present for their captive power plant. This demand is expected to increase to 171 MMCM/year by 2000-01 with the addition of a new gas turbine.

5.2.4 Industrial Estates

In order to develop the industrial infrastructure, the Gujarat government set up the Gujarat Industrial Development Corporation (GIDC) in 1962. Initially, GIDC started with seven industrial estates (cluster of industries of either the same type or different manufacturing units). Later, a number of estates were established between Vapi at the southern end of Gujarat, and Ahmedabad. As of now, GIDC has a total of 207 industrial estates spread all over Gujarat. Of these estates, between 20 to 30 are large, and house industries other than the large ones mentioned earlier, which could be expected to have some demand for natural gas. This demand will be established in the final report.

The state has 18 District Industries Centres (DIC) established with the objective to provide assistance for procurement of manufacturing inputs like credit, raw materials, power, land, etc. In order to speed up the development process, the State government has delegated several powers such as issues related to registration of cash subsidy, small scale industry (SSI) registration, certificate of sales tax exemption, etc. to the DIC's. The office of the Industries Commissioner monitors the working of all DIC's. In order to co-ordinate the activities between various agencies the Single Window Industries Follow Up Team (SWIFT) has also been constituted.

The Gujarat Industrial Investment Corporation (GIIC) promotes industrial investment in the state. While GIIC started as a financier for small-scale units, it has now become a leading development banker of the country and a promoter of medium and large-scale projects. The corporation finances medium and large-scale projects for a total project cost up to Rs. 50 million. The corporation also provides syndicated loans for projects that exceed investments beyond Rs. 50 million.

The Gujarat Small Industries Corporation (GSIC) renders assistance in procurement of material for the small-scale sector via its depots. The marketing department of the corporation takes up marketing of goods produced by this sector on an all India basis. The corporation also provides assistance in import of raw materials.

5.3 POTENTIAL GAS DEMAND

The discussions held with potential customers of regassified LNG have highlighted the fact that there is a large shortfall in the allocations made by GAIL for natural gas. Industries are acutely aware of the fact that naphtha is a much more expensive fuel than gas, but are forced to use it due to lack of an alternative. Capacity expansions are also planned mainly on the basis of naphtha as fuel (or feedstock in case of fertilisers) as gas is not available.

The potential gas demand has been calculated on a preliminary basis at present, for the industries that have already been visited. The gas demand, as presented here,

includes the unsatisfied demand. While calculating the gas demand, it has been assumed that regassified LNG will be competitively priced with respect to alternative fuels. The locations of the major industries and power stations in Gujarat are shown in the map at the end of the chapter.

The final report will provide greater detail on the demand numbers. The final demand numbers will also include new industrial customers and power stations, as well as domestic demand.

The preliminary estimates of gas demand are shown in Table 5.2.

Table 5.2: Preliminary gas demand estimates

Facility	Existing Allocation MMCM/yr	Existing Demand MMCM/yr	Additional Demand MMCM/yr	Expected By Year	Total MMCM/yr	MMTPA of LNG
NTPC	1825	2061	2061	2001/02	4122	3.01
AEC	146	130	195	2001/02	325	0.24
GTEC	548	1052	1052	2001/02	2104	1.54
Essar Power	0	818	818	2001/02	1636	1.20
GIPCL	256	397	208	N/A	605	0.44
GEB	438	1462	72	2001/02	1534	1.12
GEB	438	-	176	2006/07	1710	1.25
GSFC	310	282	118	1999/00	400	0.29
KRIBHCO	1095	1076	429	2001/02	1505	1.10
GNFC	329	877	401	2001/02	1278	0.93
IPCL	329	253	117	N/A	370	0.27
RIL	274	377	0	-	377	0.28
Essar Steel	639	970	0	-	970	0.71
Gujarat Refinery	402	114	57	2000/01	171	0.12
Total		9869	5704		15573	11.38

Using a conversion factor of about 1370 million cubic meters of gas to a ton of LNG, the existing demand in the industries visited is about 7.2 million tons of LNG per annum. This demand is expected to increase to about 11.2 MMTPA by 2001/02 and to 11.4 MMTPA by 2006-07.

CHAPTER 6

PRELIMINARY ENERGY PROJECTIONS

6.1 INTRODUCTION

Long-term demand for coal, oil and electricity are projected for the years 2015, 2020 and 2025 for the state of Gujarat. Gas demand for 2020 and 2025 will be determined after the detailed sector wise projections are made for the fuel till 2015 as gas has been in considerable short supply and past trends are therefore no guide to the future.

The approach adopted for coal, oil and electricity demand projections is to relate growth of these energy sources to the growth in the state domestic product (SDP). The SDP is the sum of value added by the different sectors (primary, secondary and tertiary) in the state economy. Value added for a sector is defined as the value of output less the value of inputs. Energy-SDP elasticities, which indicate the percentage change in fuel demand for a percentage change in SDP, are projected for these fuels/energy sources.

$$\text{Energy - SDP Elasticity} = \frac{\text{percentage change in fuel demand}}{\text{percentage change in SDP}}$$

The energy-SDP elasticity captures changes in the composition/mix of economic activity, in the efficiency of energy utilisation, substitution of fuels (due to price and income effects) as well as the fuel availability over time. The elasticity is estimated as a function of change in fuel demand and change in SDP, but incorporates the above effects. Sufficient data are not available to separate these components. These energy-SDP elasticities for coal, oil and electricity are projected for the future based on past trends. The product of the elasticity and the growth in the SDP determines the growth in demand for each fuel.

6.2 SDP GROWTH

The level of development in the state of Gujarat is higher relative to most other states (higher level of infrastructure development and higher share of manufacturing in GDP compared with the average all-India levels). In comparison with the adjacent states of Maharashtra, Rajasthan and Madhya Pradesh, it has the highest infrastructure development index, per capita power and petroleum products consumption. The index of per capita SDP for Maharashtra (141.2) is higher than that for Gujarat (113.9), but much lower than Rajasthan (56.2) and Madhya Pradesh (63.0).

Table 6.1 gives the salient socio-economic indicators for Gujarat.

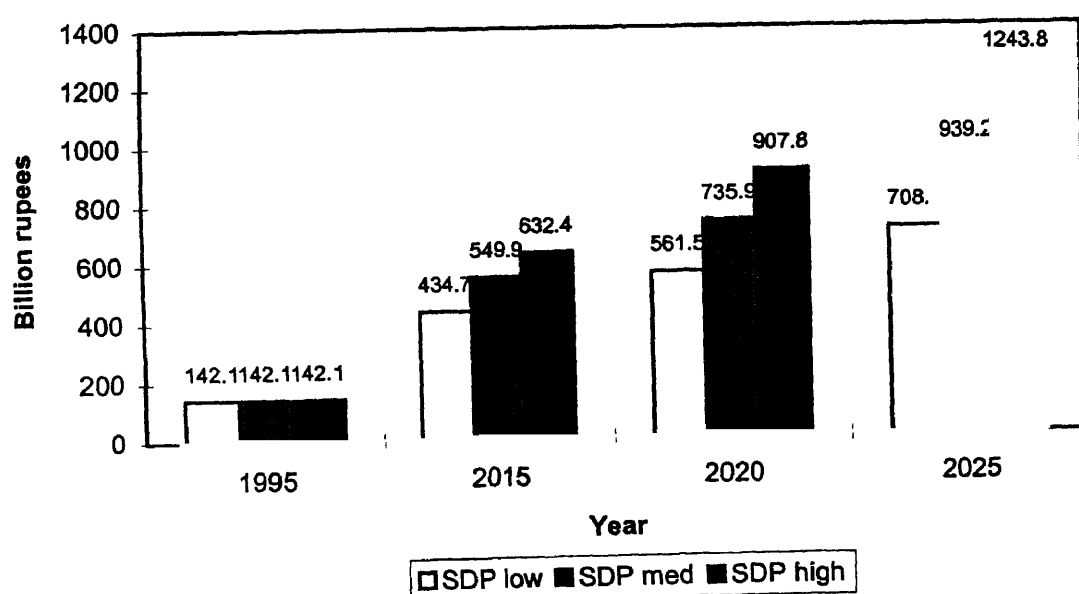
Table 6.1: Gujarat – socio-economic indicators

Indicator	All-India	Gujarat
Relative index of per capita SDP (1994/95)	100.0	113.9
Literate population in 1991 (%)	52.2	61.3
Relative infrastructure development index (1993/94)	100.0	122.4
Per capita power consumption in 1994 (kWh)	270.0	520.0
Per capita petroleum products consumption in 1994 (kg)	68.1	139.2
Per capita coal consumption in 1994 (kg)	260.6	366.4
Share of manufacturing in economic activity in 1994/95 (%)	27.5	35.2

The national economy is expected to grow at an annual rate of 6.5 percent per annum till the year 2025. The following three economic growth scenarios are considered for Gujarat.

<i>Low Scenario</i>	Net SDP grows at 5.5 percent per annum over 1995-2025, where the rate of growth is less than that projected for the national economy.
<i>Medium Scenario</i>	Growth rate in Net SDP at 6.5 percent per annum over the period 1995-2025, here the growth rate matches the average growth in the country.
<i>High Scenario</i>	Net SDP grows at 7 percent per annum over 1995-2025, where Gujarat's economy grows at a faster rate than the national economy.

Figure 6.1 shows the growth of the net SDP for Gujarat, for the three scenarios.

Figure 6.1: Net State Domestic Product for Gujarat (1980/81 prices)

6.3 ENERGY-SDP ELASTICITIES

Energy-wise SDP elasticities for the past and projections for the future for Gujarat are shown below. Compared to the national level, coal and oil related elasticities for Gujarat are and will be much lower. Concentration of coalfields in the eastern part of the country increases the transportation costs for coal, making it a less preferred fuel for Gujarat. Higher availability of gas in the state has reduced the share of oil products in the total energy demand.

Table 6.2 and Figure 6.2 show the energy-SDP elasticities for Gujarat, while Table 6.3 shows the same for India.

Table 6.2: Gujarat Energy-SDP Elasticities

Year	Coal-SDP	Oil-SDP	Electricity-SDP
1985	1.13	0.57	1.47
1989	0.98	0.51	1.81
1993	0.79	0.50	1.18
2015	0.31	0.31	0.69
2020	0.24	0.29	0.60
2025	0.20	0.26	0.52

Figure 6.2: Energy-SDP Elasticities for Gujarat

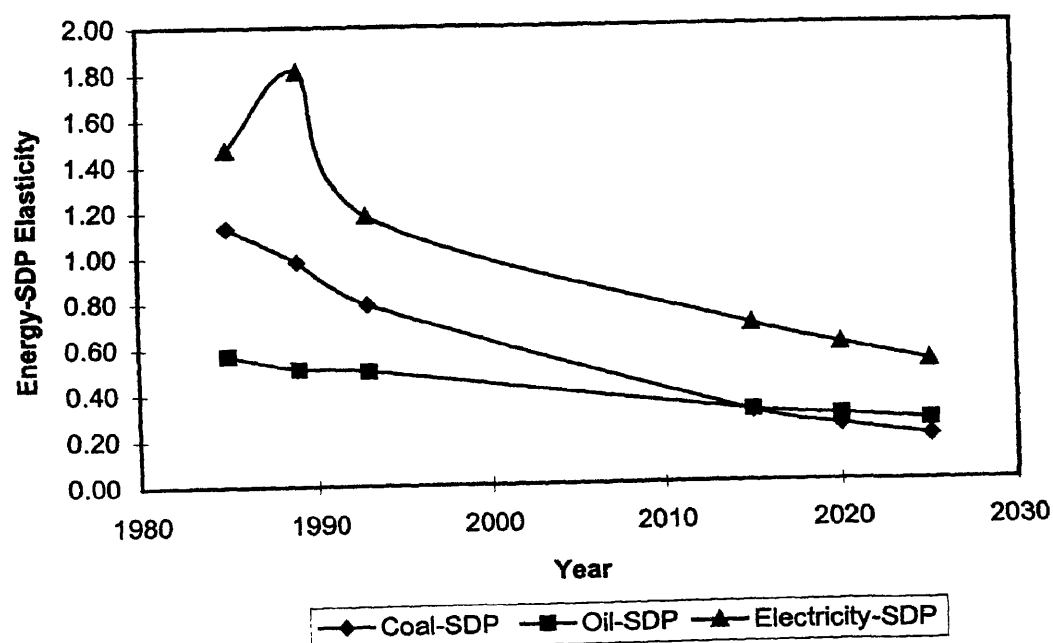


Table 6.3: All-India Energy-GDP Elasticities

Year	Coal-SDP	Oil-SDP	Electricity-SDP
1989	1.31	1.09	1.91
1993	0.96	1.34	1.61
2000	0.90	1.10	1.33
2005	0.80	1.00	1.10
2010	0.70	0.90	0.90
2020	0.50	0.80	0.63

6.4 LONG TERM ENERGY PROJECTIONS

Based on the above projections for energy-SDP elasticities and the economic growth rate, demand for coal, oil and electricity for the three economic scenarios are given in Tables 6.4, 6.5 and 6.6.

Table 6.4: Projections — Low Growth Scenario

Year	Coal Thousand tonnes	Oil Thousand tonnes	Electricity GWh
1995	15862	7531	26444
2000	18917	8498	35311
2005	21831	9504	45630
2010	24520	10541	57252
2015	26936	11599	69960
2020	28854	12570	82195
2025	30326	13438	93417

Table 6.5: Projections — Medium Growth Scenario

Year	Coal Thousand tonnes	Oil Thousand tonnes	Electricity GWh
1995	15862	7531	26444
2000	19675	8739	37511
2005	23458	10029	51194
2010	27065	11394	67468
2015	30393	12823	86160
2020	32904	14067	103641
2025	34680	15095	118610

Table 6.6: Projections — High Growth Scenario

Year	Coal Thousand tonnes	Oil Thousand tonnes	Electricity GWh
1995	15862	7531	26444
2000	20148	8888	38882
2005	24501	10364	54820
2010	28734	11949	74405
2015	32705	13632	97573
2020	36185	15336	123069
2025	38801	16837	146880

In all scenarios there is a decline in the growth rate for all three fuels (coal, oil and electricity). Growth in coal demand is the lowest from about 2.7 % to 3.7 % till 2015 and 1.0 % to 1.4 % by 2025. The annual growth rates for electricity demand range from 5.0 % to 6.1 % till 2015 and fall in the range of 2.6 % to 3.6 % for the different economic growth scenarios. The Fifteenth Electric Power Survey (15th EPS) has indicated electricity demand for Gujarat at 64356 GWh for 2006/07 and at 84111 GWh for 2011/12. The electricity demand projected here is substantially lower than those in the 15th EPS. In the High Growth Scenario, electricity demand projections are approximately 7% lower than the 15th EPS projections. The analysis here assumes that with the removal of market distortions in the energy markets, demand will be more price responsive bringing about improvements in efficiency of energy utilisation.

6.5 AVAILABILITY OF FUELS

The availability of different fuels in the past is not an appropriate indicator of future fuel availability. In the final report, an assessment of the economics and availability of all fuels will be undertaken to determine the gap in energy demand and supply and the impact this is likely to have on growth of coal, oil and electricity and the consequent demand for gas.